Pneumococcal Vaccine: Beyond 13 Serotypes

Tests for a 15-valent pneumococcal conjugate vaccine are underway, but other strategies are needed.

BY SHERRY BOSCHERT

EXPERT ANALYSIS FROM THE ANNUAL MEETING OF THE AMERICAN ACADEMY OF PEDIATRICS

SAN FRANCISCO – Hard on the heels of approval of the 13-valent pneumococcal conjugate vaccine in early 2010, tests of a 15-valent pneumococcal conjugate vaccine are underway, and researchers are looking for new strategies beyond adding more and more pneumococcal serotypes to the vaccine.

"We can't keep adding new serotypes. There are 92 serotypes," Dr. Sheldon L. Kaplan said at the meeting. One target may be a vaccine that's directed against noncapsular epitopes, suggested Dr. Kaplan, professor of pediatrics and head of the pediatric infectious diseases section at Baylor College of Medicine, Houston.

Meanwhile, the experimental 15-valent pneumococcal conjugate vaccine (PCV15) would add serotypes 22F and 33F – two of the five most common serotypes seen in invasive pneumococcal disease today. Since the introduction of the first 7-valent pneumococcal conjugate vaccine (PCV7) in 2000, invasive disease from those seven serotypes (4, 6B, 9V, 14, 18C, 19F, and 23F) has nearly disappeared, but disease from non-PCV7 serotypes has been on the rise since at least 2004.

In 2006-2007, 5% of isolates from invasive pneumococcal disease in children younger than 5 years old contained serotype 22F, and 5% contained 33F, which promoted these isolates to candidates for the PCV15 vaccine (J. Infect. Dis. 2010;201:32-41).

The most important serotype accounting for nearly half of invasive pneumococcal disease since introduction of the PCV7 vaccine – serotype 19A – was added to the 13-valent pneumococcal vaccine (PCV13) that was licensed in early 2010. The 2006-2007 data showed that 47% of invasive pneumococcal infections in children under 5 years of age was due to serotype 19A. Other data show that perhaps half of 19A isolates are resistant to three or more classes of antibiotics.

The PCV13 vaccine (Prevnar 13, made by Wyeth Pharmaceuticals Inc. and marketed by Pfizer Inc.) also added serotypes 1, 3, 5, 6A, and 7F. "Serotypes 1 and 3 are very important causes of pneumonia, especially pneumonia with empyema. We don't see much serotype 5 in the United States, so it's not going to make much of an impact there," Dr. Kaplan said.

The success of PCV7 stokes hopes that PCV13 could have an equally dramatic impact. "I think we're going to see a major decline in invasive disease due to adding these nonvaccine serotypes to the PCV13," perhaps reducing the current numbers of invasive pneumococcal disease by 70%, he added.

The Advisory Committee on Immunization Practices (ACIP) and the Red Book by the American Academy of Pediatrics' Committee on Infectious Diseases recommend administering PCV13 routinely to children at 2 months of age and suggest a catch-up schedule for children with incomplete vaccination histories.

Centers for Disease Control and Prevention monitoring after introduction of the PCV7 vaccine showed a 70%-75% reduction in overall invasive pneumococcal disease, Dr. Kaplan said.

His institution is part of a coalition of eight children's hospitals that have been monitoring invasive pneumococcal disease since 1994, covering a surveillance population of around 19 million people. Cases of invasive pneumococcal disease decreased from an average of 400-500 cases per year before the PCV7 vaccine to a nadir of 100-200 cases per year in 2004, but the number has slowly crept up since then to 221 cases in 2009, he said (Pediatrics 2010;125:429-36).

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DR. KAPLAN

As in CDC data, serotype 19A accounts for about half of invasive pneumococcal disease cases in the network's surveillance, he added. The network data also show that the most prominent type of infection before PCV7, bacteremia, fell from approximately 60% of cases to around 40% of cases post-PCV7. Pneumonia increased from 20% of cases to 30%, and the proportion of isolates associated with bacterial meningitis remained relatively steady, between 11% and 17%.

"In our multicenter study, cases of culture-proven pneumococcal pneumonia declined from 80-100 kids per year to about 40-50 cases/year in 2004, and have slowly climbed back up to more than 60 cases per year," entirely due to serotypes not included in PCV7, Dr. Kaplan said.

Although PCV7 was associated with a modest decline in cases of acute otitis media and in the use of antibiotics to treat AOM, at least until 2004, multidrug-resistant serotype 19A is playing a larger role in AOM. "In our studies, 19A accounts for about 60% of pneumococcal isolates recovered from children who have draining ears, myringotomies," and pressure equalization tubes, he said. "As a result, we're seeing an increasing number of kids with pneumococcal mastoiditis," he added. Mastoiditis cases declined from around 5-10 cases per year before PCV7 to 3-4 cases per year, but have totaled 15-25 cases per year in the past few years. The main serotype associated with mastoiditis is 19A, but serotype 3 also plays an important role, he said. Both are included in PCV13.

Dr. Kaplan has received grants from Pfizer Inc. and Sanofi Pasteur for investigator-initiated studies, and is a member of pediatric advisory committees for Pfizer, Novartis, and Sanofi Pasteur. He said he has received honoraria from Pfizer, Novartis, GlaxoSmithKline, and Sanofi Pasteur. ■

When to Use Postexposure HIV Regimens in Children

BY BRUCE JANCIN

EXPERT ANALYSIS FROM AN ANNUAL CONFERENCE ON PEDIATRIC INFECTIOUS DISEASES

VAIL, COLO. – A 5-year-old boy finds a used condom in the park. He decides it's a really cool balloon, so he puts it in his mouth and tries to blow it up.

Would you offer HIV postexposure prophylaxis or not?

How about prophylaxis for a 3-year-old girl with an accidental fingerstick from a needle she found while playing in a park? Or for an 18-month-old girl in a homeless shelter who reached under a sofa cushion and discovered treasure in the form of an old tampon with dried blood on it, which she promptly put in her mouth? Or a 3-year-old boy who cut himself on the cheek while pretending to shave with a used razor belonging to his HIV-positive uncle?

The pediatric infectious diseases staff at the Children's Hospital, Denver, has encountered all of these situations. Those clinicians recommended HIV postexposure prophylaxis in only one of the four cases: the boy who sustained a large laceration while playing with his HIV-positive uncle's razor, Heather R. Heizer said at the conference, which was sponsored by the hospital.

That is consistent with a generally conservative approach to postexposure prophylaxis that prevails among the hospital's infectious diseases staff. That stance is based upon the intervention's substantial financial cost, significant toxicities, and a complete absence of pediatric clinical trials data that might help guide clinical decision making, explained Ms. Heizer, a physician assistant and instructor in pediatrics at the hospital and the University of Colorado, Denver.

When the Denver pediatric infectious diseases staff does offer HIV postexposure prophylaxis following nonsexual, nonoccupational exposures, the favored approach – based largely upon animal studies – is a triple-drug antiviral regimen that is prescribed for 28 days, but only if it can be started within 72 hours of the exposure.

In children younger than age 13 years who may have difficulty swallowing pills, the staff generally uses 28 days of zidovudine (Retrovir), lamivudine (Epivir), and Kaletra (a combination of lopinavir plus ritonavir), because all are available in liquid formulations. Older children receive Combivir (zidovudine plus lamivudine) and Truvada (tenofovir plus emtricitabine), or Combivir plus Kaletra.

HIV transmission requires exposure to an infectious body fluid (defined as blood, breast milk, semen, or vaginal secretions) through broken skin or mucous membranes. Saliva, tears, and urine are considered noninfectious unless blood is visibly present. The half-life of HIV in serum is about 1.2 days; the virus can survive only for about 6 hours extracellularly.

Returning to her specific case examples of potential HIV exposure, Ms. Heizer said that the pediatric infectious diseases staff declined to offer prophylaxis to the young girl in the homeless shelter with the bloody tampon. The tampon was old and the blood was dried, making for an extremely low HIV transmission risk.

Similarly, the boy with the "balloon" was deemed at very low risk because the condom was old and dried out, with no visible blood or semen.

The girl who stuck herself with a needle that she found in a park was not offered postexposure prophylaxis, Ms. Heizer explained, because there was no visible blood in the needle, the park wasn't thought to be a hangout for injection drug use, and exposure to discarded needles is generally thought to carry a low risk of transmission. That last point was demonstrated in a classic study of 308 children who were exposed to discarded needles and were subsequently tested for HIV: Not one case of transmission occurred (Pediatrics 1999;104:318-24).

More recently, pediatricians in Montreal reported on 274 patients with community-acquired needlestick injuries. In all, 82 received postexposure prophylaxis, of whom 69 completed the 4-week treatment course. No seroconversions occurred in the 274 patients, confirming that the transmission risk is quite low, Ms. Heizer noted.

She found that study particularly useful because it paints a picture of situations in which accidental pediatric needlesticks are most likely to occur, and to whom. About 29% of the needlesticks happened in a street or alley, and another 24% occurred in a park. The patients' mean age was 7.9 years. Nearly two-thirds of the injuries occurred in boys. In 65% of the injuries, the child purposely picked up the needle.

A particularly gratifying study finding was that three-quarters of the children with community-acquired needlestick injuries were brought to medical attention on the day of the injury (Pediatrics 2008;122:e487-92).

Ms. Heizer said she had no financial conflicts regarding her presentation. ■